2012
Chesterfield County
Natural Resources Indicators Report

Introduction

This marks the fourth edition of the Chesterfield County Natural Resources Indicators Report. This report provides information about the status of the natural environment of Chesterfield County through various natural resource indicators. Chesterfield County has an abundance of natural resources that have been integral in shaping the community from the time of the first inhabitants to the present. These natural resources provide an aesthetic setting to live and work, an economic base through timber and recreation, and valuable services to our community such as providing clean air and water.

The report is organized into three major topics: land, air and water. By design, the first indicator discussed is land. It is highly likely that the other indicators, air and water, will decline as the natural land base dwindles or is developed in a non-sustainable manner. It is important to not just look at the indicators individually, but as interconnected systems.

As this report continues on an annual basis, trends for the indicators will be established. Most data for this report was collected in the calendar year of 2011 except where noted. Data is obtained from a variety of sources, some of which are not updated on an annual basis. All sources of data and a listing of websites used in the report appear at the end of the report in the Data Sources Section. Data and maps contained in this report are believed to be accurate and reliable. This report, as well as other demographic and economic information, can be found on the Chesterfield County website at: http://www.chesterfield.gov, then by navigating to the Planning Department homepage.

A glossary of terms is included as Appendix A to this document. This glossary defines technical terms that are underlined in this document.

A special thank you to local photographer Jim Waggoner for providing the cover photo of the fisherman on the Swift Creek Reservoir and the turtle photo on page 4. We are grateful to Jim for allowing Chesterfield County to use his images in our many reports and plans.

Moving Forward…The Comprehensive Plan for Chesterfield County addresses natural resources in the Plan Goals and Environment chapters. This plan values environmental resources by protecting, appropriately enhancing and integrating environmental resources into development designs for the enjoyment of the community. Any questions or comments regarding this report should be directed to Heather Barrar at the Chesterfield County Planning Department's Comprehensive Planning and Research Branch at (804) 748-1778.

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At-a-Glance
Natural Resource Indicators

Land

In 2011:

- Developed 553 acres
- Protected 668 acres in 2011 and 2012
- No agriculturally zoned land was rezoned

Source: Chesterfield County Department of Environmental Engineering & Planning Department

Air

In 2010:

- Days Chesterfield County exceeded ozone standard: 4
- Richmond Region: Maintenance Area for Ozone

Source: Virginia Department of Environmental Quality

Water

In 2011:

- 28 impairments were added to the DEQ Integrated Report (2010 Report)
- 10 out of 15 streams sampled by Chesterfield County were characterized as poor or fair

Source: Virginia Department of Environmental Quality & Chesterfield County Department of Environmental Engineering

Photo by Jim Waggoner

Land

Chesterfield Land Statistics

Land Area: 285,440 acres

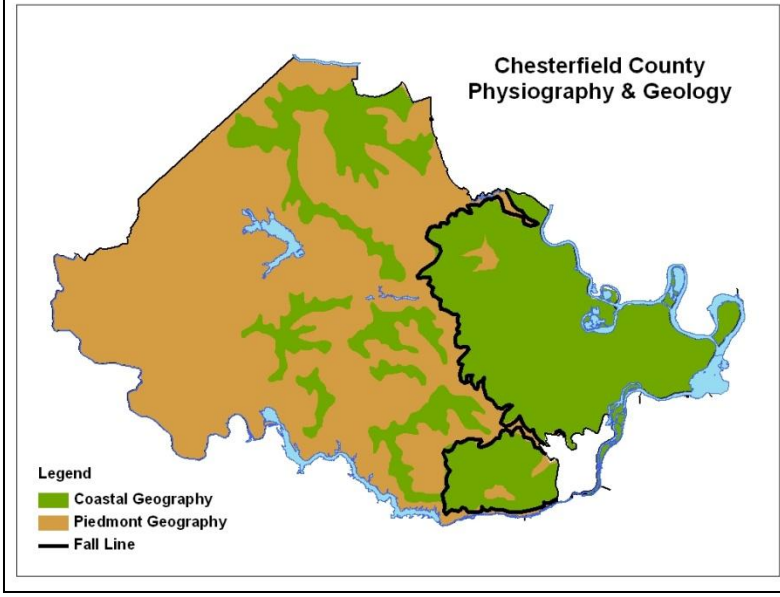
Riverfront: 92 miles along James & Appomattox Rivers

Physiographic Regions: Coastal Plain & Piedmont

In 2011:

- Developed 553 acres
- Protected 668 acres in 2011 and 2012
- No agriculturally zoned land was rezoned

Source: Chesterfield County Department of Environmental Engineering & Planning Department

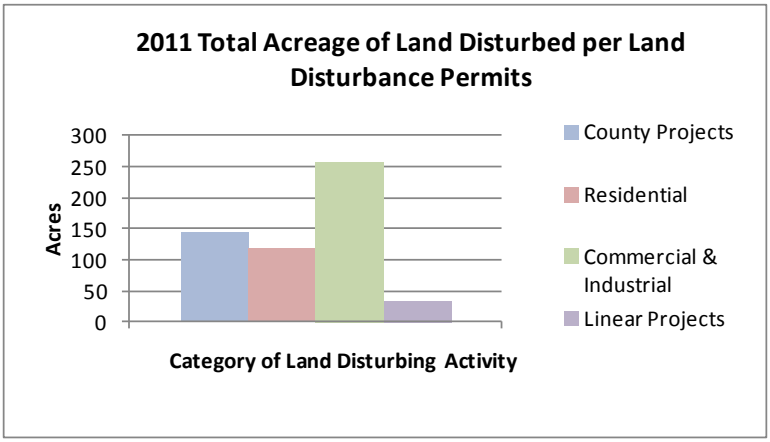


Introduction to Land

The amount and condition of the land base of Chesterfield County has a direct impact on other natural resources, the quality of life and the economy of the county, as well as jurisdictions and ecosystems hundreds of miles away like the Chesapeake Bay. Land provides the basis for other natural resources such as wildlife and plant habitat and species diversity. The land base also provides many direct benefits to humans by improving health related issues such as air and water quality, temperature abatement and general aesthetic appeal. Finally, the local economy benefits from both the timber industry and recreational opportunities that occur with an undeveloped land base. This section will explore the following three indicators: land developed, land protected and land zoned in Chesterfield County.

Land Developed

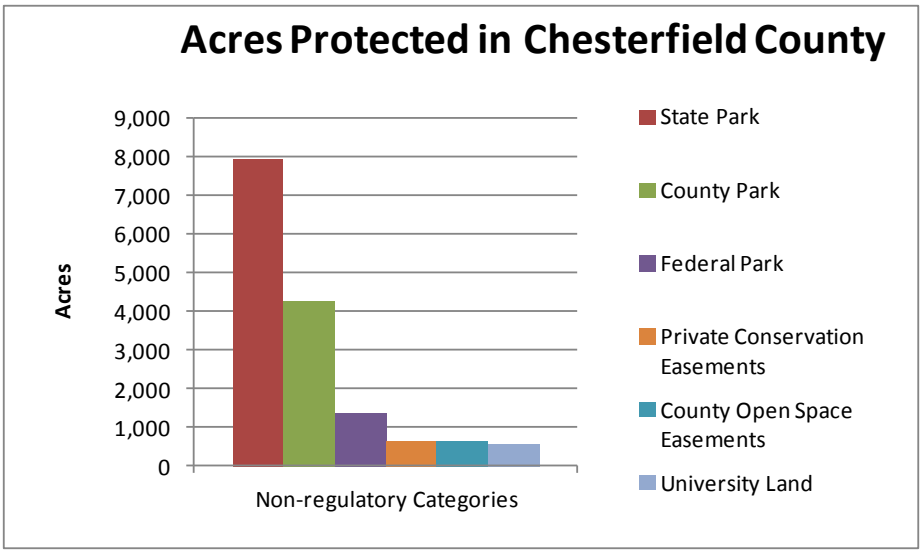
As the community of Chesterfield County continues to grow, land is developed into stores, offices, public facilities, roads and homes. In most cases, vacant or underutilized land is being converted from an agricultural or forestry use to a more intense use. However, infill development is occurring in certain portions of the county. In 2011, Chesterfield County received 780 land disturbance permits



accounting for 553 acres physically developed. This is an increase in the number of permits, but a decrease in the acreage disturbed from 2010. The number of permits increased by nine percent while the acreage decreased by 50 percent. Land disturbing activities include clearing for single family homes, subdivisions, commercial development, roads, public facilities and utilities. State, federal, gas and power projects are not subject to obtain a land disturbance permit, therefore are not included in this analysis.

Land Protected

There are various methods to conserve land and open space in a community. Chesterfield County has approximately 58,500 acres (20 percent) conserved through both non-regulatory and regulatory means. Non-regulatory actions that conserve open space include park land, conservation easements and open space easements, while the Chesapeake Bay Ordinance is a regulatory action that also accomplishes this goal.



Non-regulatory Actions

Parks: Overview

Chesterfield County contains over 14,000 acres of local, state and federal parks. The condition of land contained in these parks varies from natural woods and wetlands to highly developed playing fields, building structures and parking lots. The acreage of the park lands also varies greatly from thousands of acres to less than one acre. Park land not only conserves natural areas that contribute to wildlife habitat, watershed protection and improved air quality, but they also serve as an important recreational and economic element to the community.

Local: The Chesterfield County Parks & Recreation Department operates 57 parks and historical sites on over 4,000 acres. The largest park is the nearly 800 acre Dutch Gap Conservation Area located along the original channel of the James River on Farrar's Island. This park

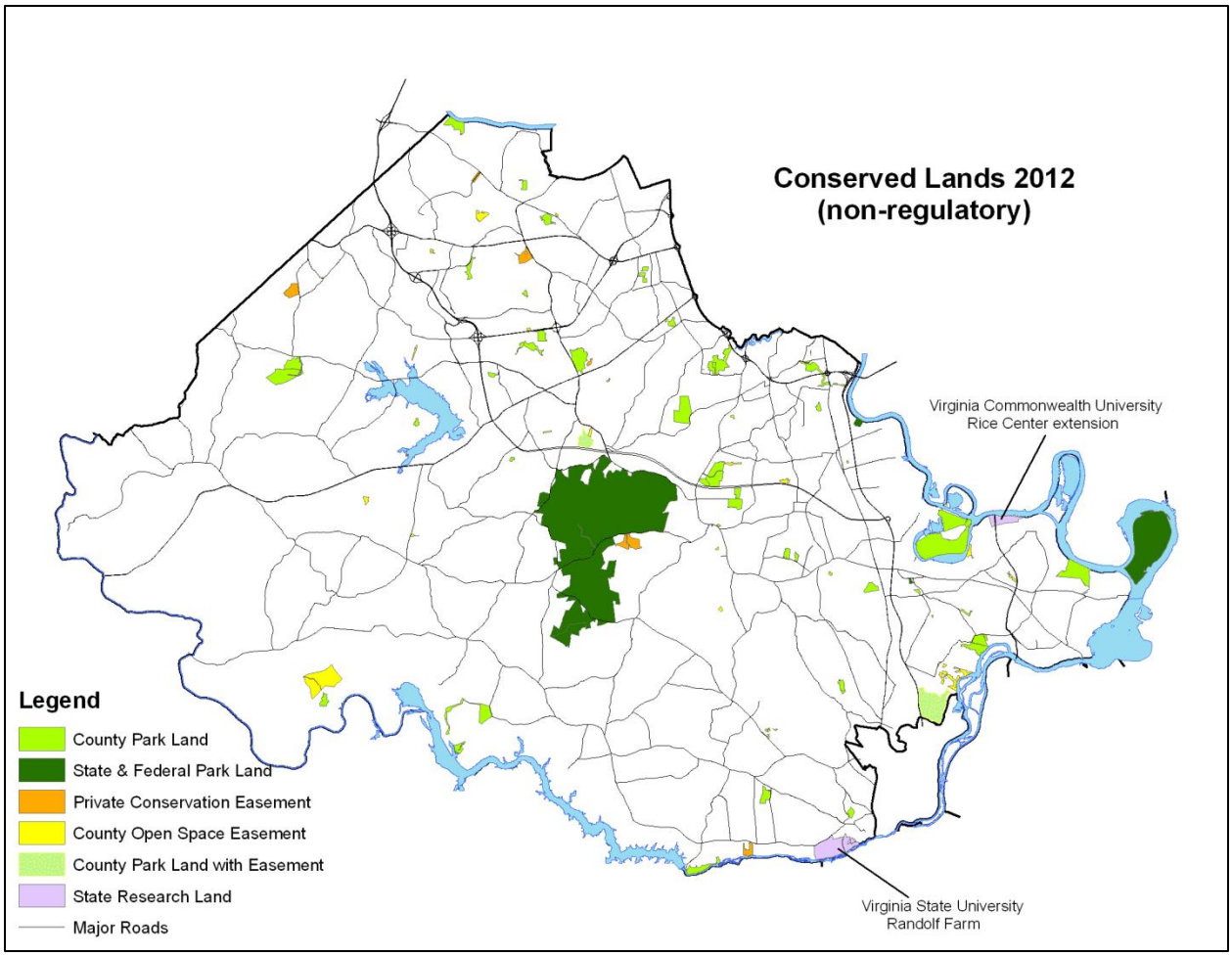
offers a natural setting for passive recreation such as hiking and paddling. Other parks offer playing fields, picnic shelters and community buildings. Some parks offer historic interpretations of our past and preserve structures and battlefields for future generations. Chesterfield County acquired approximately 580 additional acres for the local park system in 2011 and 2012. Additionally, several historic properties are currently in the process of being purchased for new park sites.

State: Chesterfield County is home to Pocahontas State Park, the largest state park in the Commonwealth of Virginia. This 7,950 acre park is located in the center of Chesterfield County and boasts a wide variety of environmental conditions from managed pine stands to developed campgrounds. It was built in 1946 by the Civilian Conservation Corps (CCC) and was the first park in the Richmond and Tri-Cities Region. Visitors can enjoy traditional park activities such as hiking and biking the extensive trail system, swimming, boating, fishing and camping, as well as participate in cultural events at the Heritage Amphitheater.

The state university system also owns property that is primarily used as research land to provide important statewide data on agriculture and river ecology. Chesterfield County has two such areas. Randolph Farm, operated by Virginia State University, or VSU, is a 407 acre property located along the Appomattox River and serves as a statewide agricultural research facility. Virginia Commonwealth University, or VCU, owns 142 acres of property adjacent to the James River. This property will serve as an extension to the Rice Center, located downriver in Charles City County. Both of these properties serve important functions both for the state in research and locally as they provide ecosystem services for the community.

Federal: The federal government operates three sites totaling over 1,350 acres in Chesterfield County. The Presquile National Wildlife Refuge is a 1,329 acre island located on the James River. It is one of four refuges in the Eastern Virginia Rivers National Wildlife Refuge Complex and serves as an important habitat to migrating waterfowl. Since the announcement in 2010 to build the James River Ecology School at Presquile Island as a partnership project between the Presquile National Wildlife Refuge and the James River Association, much progress has been made. An existing building was renovated to create the Menenak Discovery Center and the bunkhouse is under construction. For more information, please visit the following website: http://www.fws.gov/northeast/cpwn/programs/jamesriver.html. The National Park Service operates the Richmond National Battlefield Park with two sites of that system, Drewry's Bluff and Parkers Battery, located in Chesterfield County. While Civil War sites are protected for historical purposes, they also serve as important green space.

Menenak Discovery Center at Presquile National Wildlife Refuge

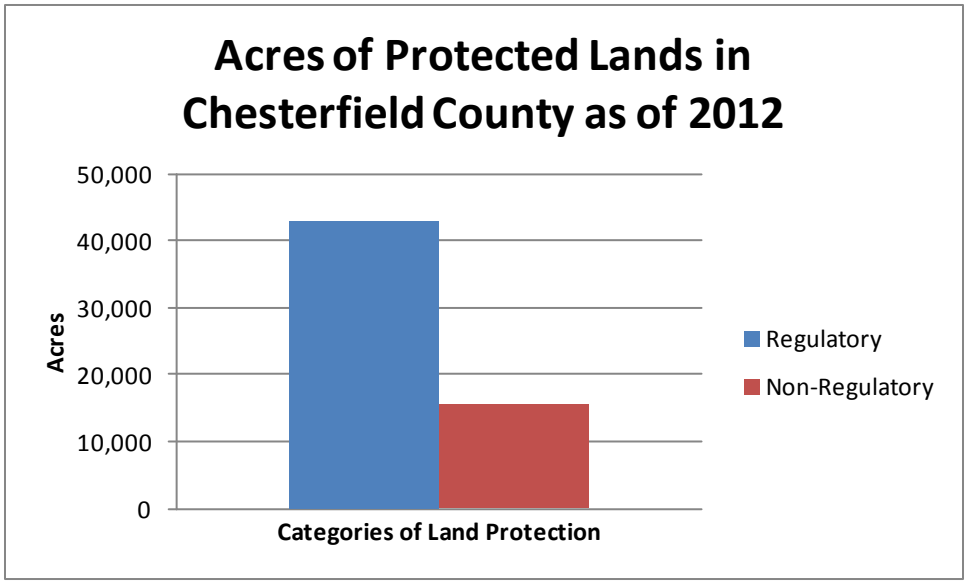


Easements: Conservation and Open Space

A conservation or open-space easement is a tool used by private landowners to protect their land from future development into perpetuity. A landowner enters into agreement with an organization (either a government agency or a nonprofit land trust) to hold the easement. This agreement is recorded in the land records of the locality and remains with the land, not the landowner. Easement agreements vary from property to property, but in general they limit the use of the property while maintaining traditional uses such as farming and forestry. Landowners can also benefit from federal and state tax programs by placing a conservation easement on their property. Two Virginia statutes enable conservation easements: The Open Space Land Act (1966), which authorizes public bodies such as local governments to hold easements, and the Conservation Easement Act (1988), which authorizes nonprofit land trusts to hold them. These statutes are very similar, but one major difference is the fact that open space easements can be held for less than perpetuity, but for at least five years. The state and federal tax incentives, however, are available only for permanent easements.

There are nine privately held conservation easements in Chesterfield County; most are held either singularly or jointly by the Virginia Outdoors Foundation and one easement is held by the Virginia Department of Historic Resources. These conservation easements account for over 600 acres of conserved forest and farm land and one historic building. One of the easements is unique as the property is owned by Chesterfield County and the easement is held jointly by the Virginia Outdoors Foundation and the Friends of Chesterfield's Riverfront. Chesterfield County was the first local government in Virginia to place a conservation easement on their own property. This property, located along the James River, is referred to as the Brown and Williamson Tract and is certified as an Important Bird Area (IBA) by The National Audubon Society. One private conservation easement was recorded in 2011.

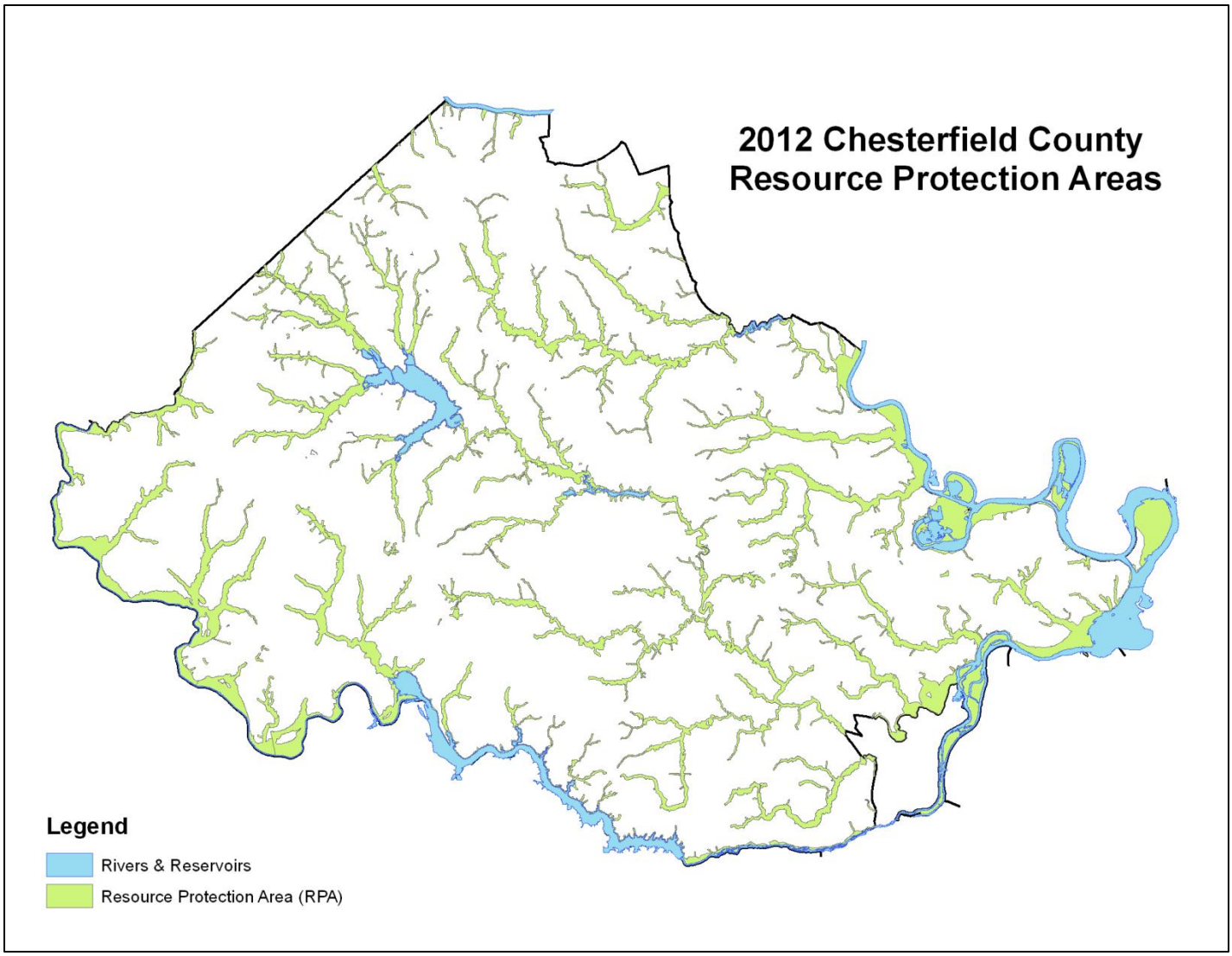
While local governments cannot legally hold conservation easements, they can hold open space easements. This program, established by the Open Space Land Act, is very similar to a conservation easement, though in this case, the easement holder is Chesterfield County. Another major difference in the programs is the fact that open space easements can be held for less than perpetuity, but for at least five years. There are 18 open space easements held by Chesterfield County accounting for over 650 acres.



Regulatory Actions

Resource Protection Areas: Streams and Wetlands

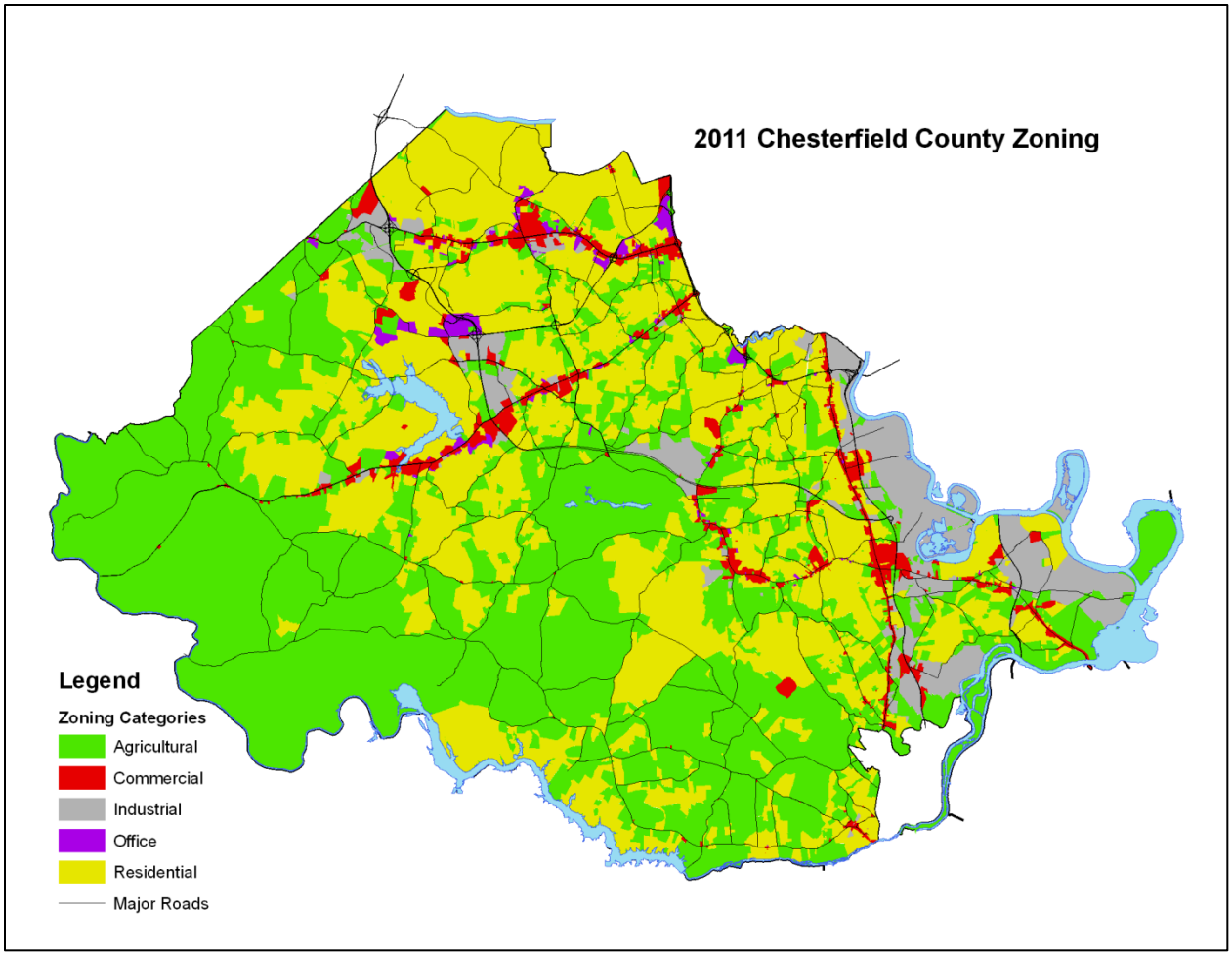
Another form of land protection in Chesterfield County occurs through the application of state and federal regulations. While these lands are owned privately, the condition of the land is protected by law. The Chesapeake Bay Preservation Act (Code of Virginia 10.1-2100 et seq) sets standards to preserve water quality through the protection and establishment of Resource Protection Areas (RPA). RPAs are buffers of land, 100 feet in width, adjacent to streams with perennial flow, tidal wetlands, and nontidal wetlands that are connected and contiguous to either a perennial stream or a tidal wetland. These lands are to be vegetated with woody vegetation and not disturbed. If disturbed, the RPA must be replanted to meet Virginia Department of Conservation and Recreation (Division of Chesapeake Bay Local Assistance) standards. RPAs may be modified for water dependant uses through the water quality impact assessment (WQIA) process. In addition to state protection, tidal wetlands are also protected at the federal level. To date, 43,035 acres of land are protected in Chesterfield County under the Chesapeake Bay Preservation act, including streams and wetlands.



Land Zoned

Zoning is the legal mechanism to change the land use on a property. In the calendar year of 2011, no agriculturally zoned land was rezoned to another zoning category such as residential, commercial or industrial. The term agriculture in relation to zoning does not imply that the land was a production farm or forest.

Zoning Change Acreage 2010 - 2011			
Zoning Class	**2010 Acres**	**2011 Acres**	**Change**
Agricultural	146,035	146,036	1
Residential	101,489	101,489	0
Commercial	9,984	9,984	0
Industrial	19,582	19,582	0
Office	2,411	2,410	-1



Air

Chesterfield Air Statistics

Air Pollutants Monitored:

- Carbon Monoxide
- Sulfur Dioxide
- Nitrogen Dioxide
- Ozone
- Particulate Matter

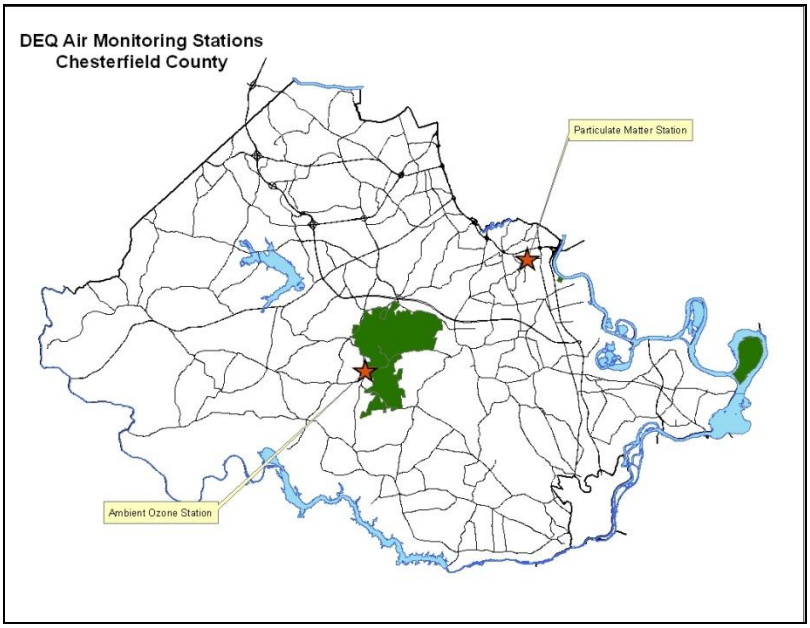
Air Monitoring Stations Located in Chesterfield:

- Ambient ozone
- Particulate matter

In 2010:

- Days Chesterfield County exceeded ozone standard: 4
- Richmond Region: Maintenance Area for Ozone

Source: Virginia Department of Environmental Quality



Introduction to Air

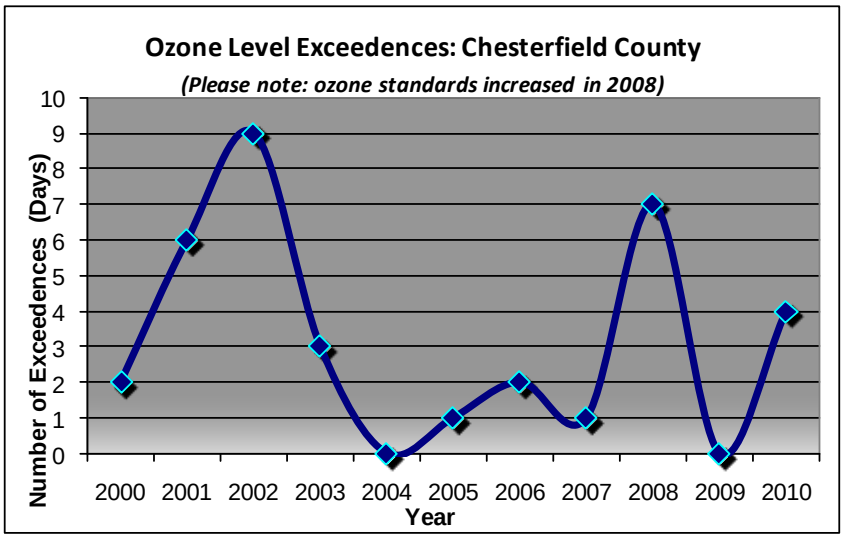
The quality of air can effect human health, environmental health and even cause damage to property. Air quality is influenced by many elements over a wide geographic range. For example, the air quality of Chesterfield County is affected not only by personal daily actions such as operating a motor vehicle, but also by the emissions of a major industry located hundreds of miles away. National Ambient Air Quality Standards (NAAQS) are set by the Environmental Protection Agency (EPA) and air quality is monitored by the Virginia Department of Environmental Quality (DEQ). Ambient air is monitored for five criteria pollutants: carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone and particulate matter. The EPA sets primary standards (to protect health) and secondary standards (to protect the environment) for the criteria pollutants. Air quality is considered at a regional scale with Chesterfield County being in the Richmond Area along with the following jurisdictions: Charles City County, Hanover County, Henrico County, Prince George County, City of Colonial Heights, City of Hopewell, City of Petersburg and City of Richmond. If any of the five criteria pollutants are not met, then that area is considered to be a Nonattainment Area by the EPA. Two DEQ monitoring stations are located in Chesterfield County. A station at the intersection of Beach Road and Spring Run Road collects data on ambient ozone levels while a station at the Defense Supply Center on Jefferson Davis Highway monitors particulate matter ($PM_{2.5}$). The following tables explore the cause and effects of air quality pollutants as well as the standards set by the EPA for each pollutant. Finally, it is noted for each pollutant whether the region meets the standard.

The Cause & Effects of Air Pollutants Monitored in the Commonwealth of Virginia			
Pollutant Name	**Description**	**Cause**	**Effect**
Carbon Monoxide (CO)	Colorless, odorless gas	Produced by incomplete burning of carbon compounds in fossil fuels	Reduces the amount of oxygen supplied to the heart and brain
Sulfur Dioxide (SO_2)	Colorless gas, strong odor	Result of burning fuel that contains sulfur such as coal and oil	Respiratory issues, acid rain damages plants and water and aquatic life, creates haze and reduced visibility
Nitrogen Dioxide (NO_2)	Reddish brown gas, pungent odor – one of a group of gasses referred to as NO_x	Result of high-temperature burning of fossil fuels	Contributes to the formation of ground-level ozone which can cause lung and respiratory issues
Ozone (O_3)	Colorless gas	Formed by a reaction of sunlight and volatile organic compounds (VOC) such as motor vehicle exhaust, power plants, fires	Lung and respiratory issues, damages plants and private property such as paint and rubber deteriorate more quickly
Particulate Matter ($PM_{2.5}$)	Matter that is less than or equal to 2.5 micrometers in aerodynamic diameter	Dust, smoke, fumes, soot	Particulate matter may enter lungs or bloodstream causing both short term irritation and lasting damage

Primary Standards for Air Pollutants			
Pollutant Name	**Monitoring Station Location**	**Primary Standard**	**Region Meets Standard in 2010?**
Carbon Monoxide (CO)	Richmond	• 8-hour average not to exceed 9 ppm (10 mg/m^3) more than once per year • 1-hour average not to exceed 35 ppm (40 mg/m^3) more than once per year	Yes
Sulfur Dioxide (SO_2)	Richmond, Charles City County	• Annual Arithmetic Mean not to exceed 0.03 ppm (80 µg / m^3). • 24-Hour concentration not to exceed 0.14 ppm (365 µg / m^3) more than once per year.	Yes
Nitrogen Dioxide (NO_2)	Richmond, Charles City County	• Annual Arithmetic Mean not to exceed 0.053 ppm (100 µg / $m^{3)}$.	Yes
Ozone (O_3)	Counties of: Chesterfield, Henrico, Charles City, Hanover	• Maximum 8-hour average concentration of 0.075 ppm (157 µg / m^3), based on 3-year average of the annual fourth highest daily maximum 8-hour averages. *(new standard in 2008)*	Yes
Particulate Matter ($PM_{2.5}$)	Counties of: Chesterfield, Henrico, Charles City	• Annual Arithmetic Mean – the 3 year average of the weighted annual mean PM2.5 concentration must not exceed 15.0 µg/ m^3. • 24-Hour concentration – the 3 year average of the 98th percentile of 24-hour concentrations must not exceed 35 µg/ $m^{3.}$	Yes

Maintenance Area: Ozone

In 2010, the Richmond Region did not exceed the 0.075 ppm ambient ozone standard and continues to be considered a Maintenance Area for ozone. This means that the region must establish a maintenance plan to meet and maintain air quality standards since the region was previously considered a Nonattainment Area.



Source: Department of Environmental Quality

The Richmond Region reported 10 days when an eight-hour ozone average greater than the standard was recorded; the Chesterfield County ambient ozone monitoring station reported four days. Statewide, only one region exceeded ozone pollution standards.

2008-2010 Fourth Highest Daily Maximum 8-Hour Ozone Averages (unit: parts per million)					
	Monitor Location	**2008**	**2009**	**2010**	**3-Year Average (NAAQS=.075 ppm)**
Richmond Maintenance Area	Chesterfield County	0.080	0.065	0.081	0.075
	Henrico County	0.086	0.065	0.079	0.076
	Hanover County	0.080	0.067	0.078	0.075
	Charles City County	0.084	0.063	0.078	0.070

Source: Department of Environmental Quality

Chesterfield Water Quality Statistics

Watersheds: 20 Sixth Order Hydrologic Units

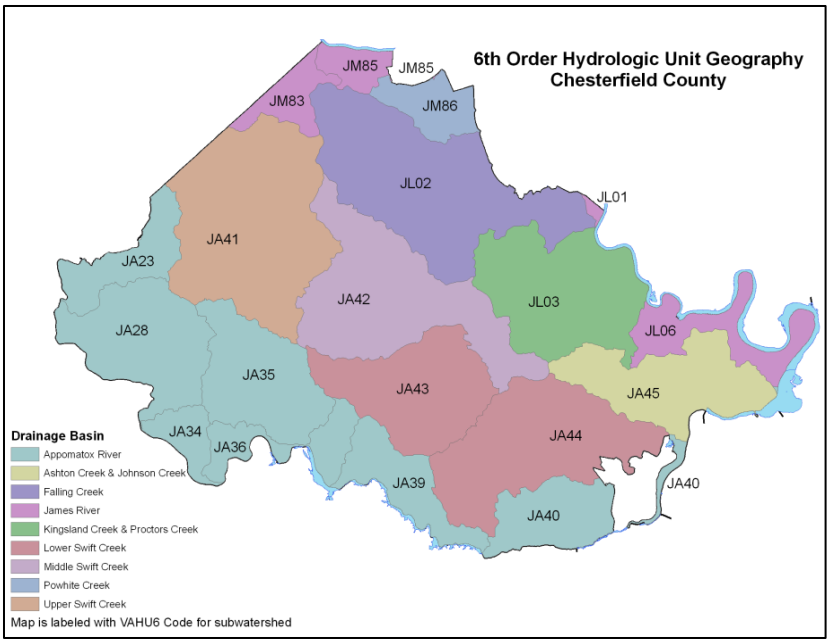
Streams: Over 2,000 miles of streams

Reservoirs & Lakes: 3 reservoirs; hundreds of lakes & ponds

In 2011:

- 28 impairments were added to the DEQ Integrated Report (2010 Report)
- 10 out of 15 streams sampled by Chesterfield County were characterized as poor or fair

Source: Virginia Department of Environmental Quality & Chesterfield Department of Environmental Engineering



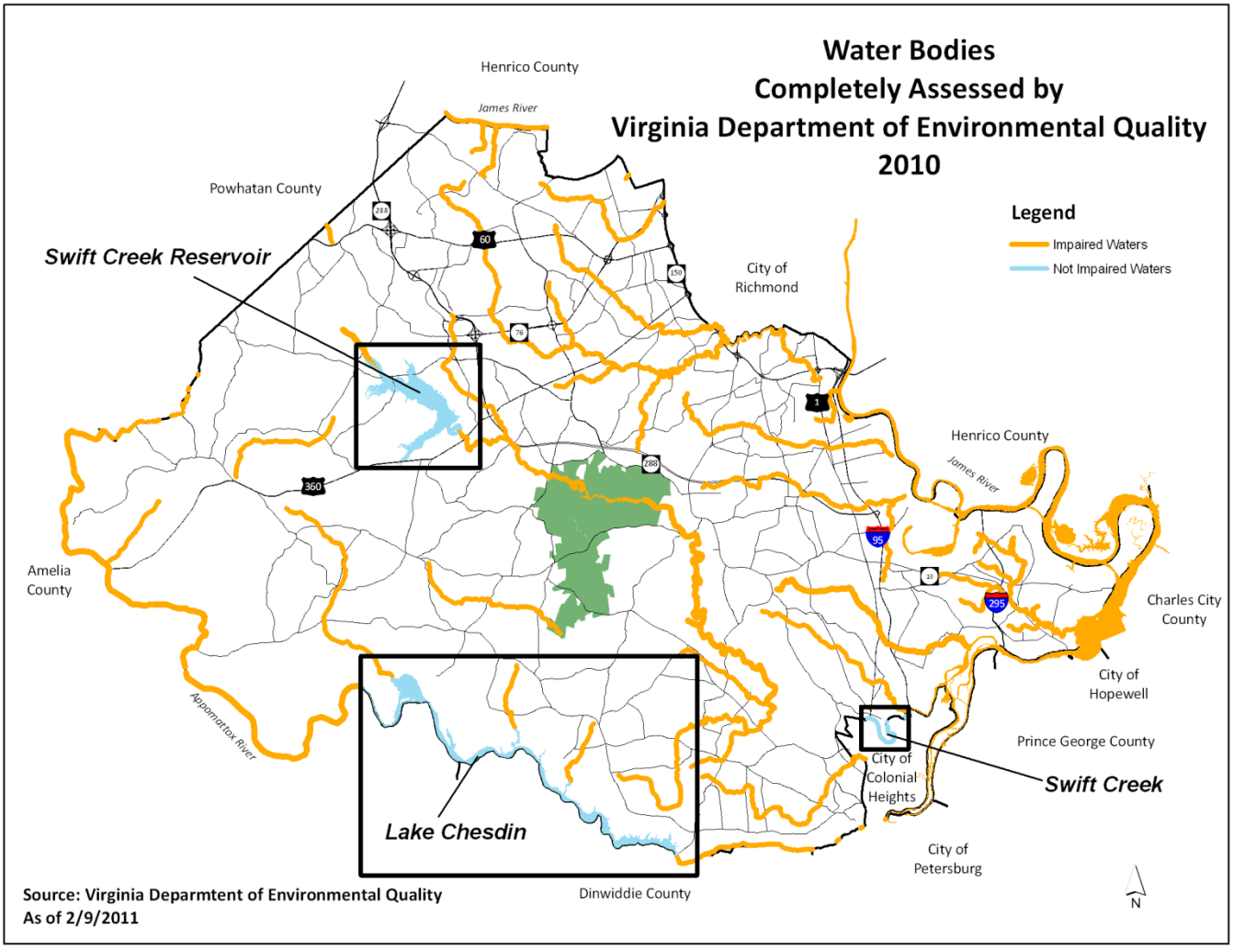
Introduction to Water

The waters of Chesterfield County play an important role in public health and recreation. We not only rely on surface water as a major source of drinking water, but we also enjoy the recreational benefits of hiking along streams as well as swimming and boating on the lakes and rivers. Both the Commonwealth of Virginia and Chesterfield County make efforts to monitor the quality of streams, lakes and rivers. Water can become polluted from a variety of sources including run-off from land and deposition from the air. Some common water quality pollutants in Chesterfield County include nutrients from fertilizers, bacteria from animal waste and sediment from land clearing and stream channel erosion. Increased water volume from impervious surfaces can also be a cause of impairments as the natural flow of water is altered. This pollution can damage the plant and animal life that lives in and around the water and in extreme cases can cause human illnesses as well. Storm water run-off is often used to refer to the decrease of water quality and increase of water quantity as rain moves through a developed landscape.

State Monitoring Efforts

The Virginia Department of Environmental Quality (DEQ) is mandated by the Environmental Protection Agency (EPA) to monitor the waters of the Commonwealth and submit an Integrated Report every other (even numbered) year. The Integrated Report combines the 305(b) Water Quality Assessment Report and the 303(d) Impaired Waters List. Waters are assessed for the following uses: wildlife, aquatic life, fish consumption, shellfish consumption, recreation/swimming, public water supply and the Chesapeake Bay. Waters may be listed for the following impairment categories:

violation of ambient water quality standards, fishing restrictions or advisories, shellfish consumption restrictions due to contamination, nutrient over-enrichment, significant decline in aquatic life biodiversity or populations, and contamination of sediment levels which violate water quality standards. Due to the DEQ reporting cycle, this data is only updated every other (odd) year in the Chesterfield County Natural Resources Indicators Report. The following DEQ data represents the most recent data available.



2010 Impaired Waters of Chesterfield County Appearing on the 303(d) List

2010 Impaired Lakes and Cause of Impairment			
Waterbody Name	**E. Coli**	**Dissolved Oxygen**	**pH**
Falling Creek Reservoir	X		X
Swift Creek Lake		X	

2010 Impaired Streams and Cause of Impairment				
Waterbody Name	**E. Coli**	**Dissolved Oxygen**	**pH**	**Benthic Macroinvertebrates**
Bernards Creek	X			
Blackman Creek		X	X	
Cattle Creek			X	
Church Branch			X	
Ditch to James River		X	X	
Falling Creek	X (3)	X		
Franks Branch			X	
Goodes Creek		X	X	
Horners Run	X			
Johnson Creek		X	X	
Kingsland Creek	X		X	
Licking Creek	X			
Long Swamp			X	
No Name Creek	X			
Nutree Branch		X	X	
Old Town Creek			X	X
Pocoshcok Creek	X			
Powhite Creek	X			X
Proctors Creek	X			
Rattlesnake Creek	X			
Redwater Creek		X		
Salles Creek	X	X	X	
Second Branch			X	
Stoney Creek			X	
Swift Creek		X (2)	X	X
Timsbury Creek			X	
Unnamed Tributary to James River	X	X		

( ) Parenthesis after an X denotes that the stream is listed for more than one impairment cause or for multiple sections

2010 Impaired Rivers and Cause of Impairment						
Waterbody Name	**E. Coli**	**Dissolved Oxygen**	**Aquatic Plants**	**Fecal Coliform**	**Chlorophyll-a**	**PCB***
Appomattox River			X			
James River	X	X	X	X(2)	X (2)	X (2)

( ) Parenthesis after an X denotes that the water body is listed for more than one impairment cause or for multiple sections

All impairment terms are found in the glossary of this document*

Changes to the 2010 Integrated Report

New Impairments:

- Cattle Creek
- Church Branch
- Falling Creek Reservoir
- Goodes Creek (2)
- James River (upper) Tidal Freshwater Estuary
- James River (lower) Tidal Freshwater Estuary (2)
- Long Swamp
- Nuttree Branch (2)
- Oldtown Creek (2)
- Proctors Creek
- Rattlesnake Creek
- Redwater Creek
- Salles Creek (2)
- Second Branch
- Stoney Creek
- Swift Creek (3)
- Timsbury Creek
- Unnamed Tributary to James River (2)

Delisted:

- James River (2)
- Lake Chesdin
- Lakeview Reservoir
- Oldtown Creek
- Skinquarter Creek
- Swift Creek
- Winterpock Creek (2)

Natural Impairments:

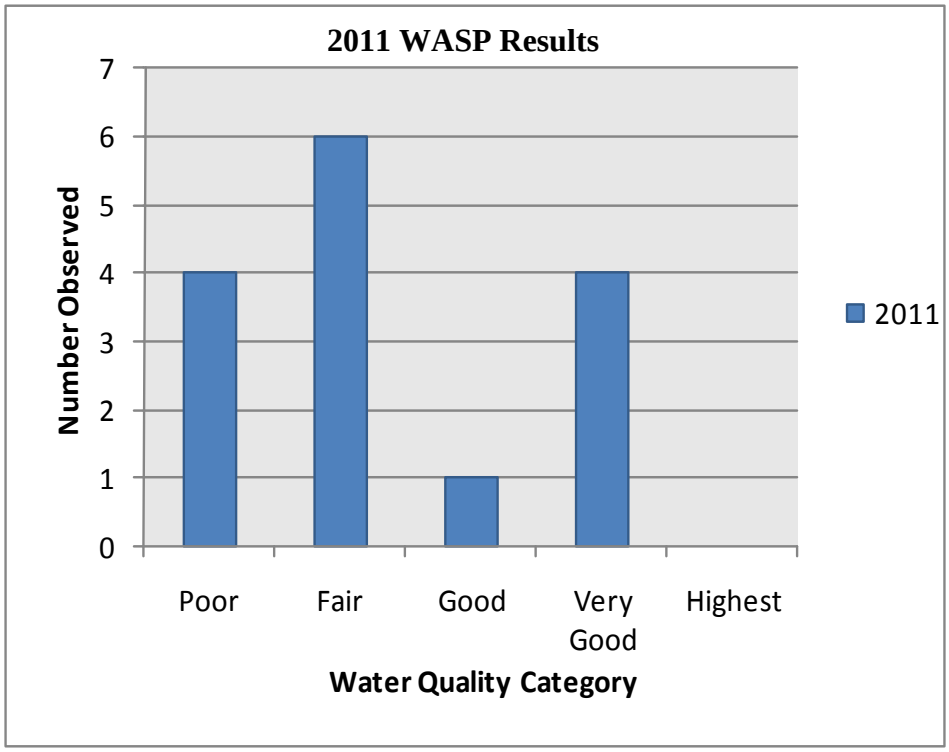
- Skinquarter Creek
- Winterpock Creek

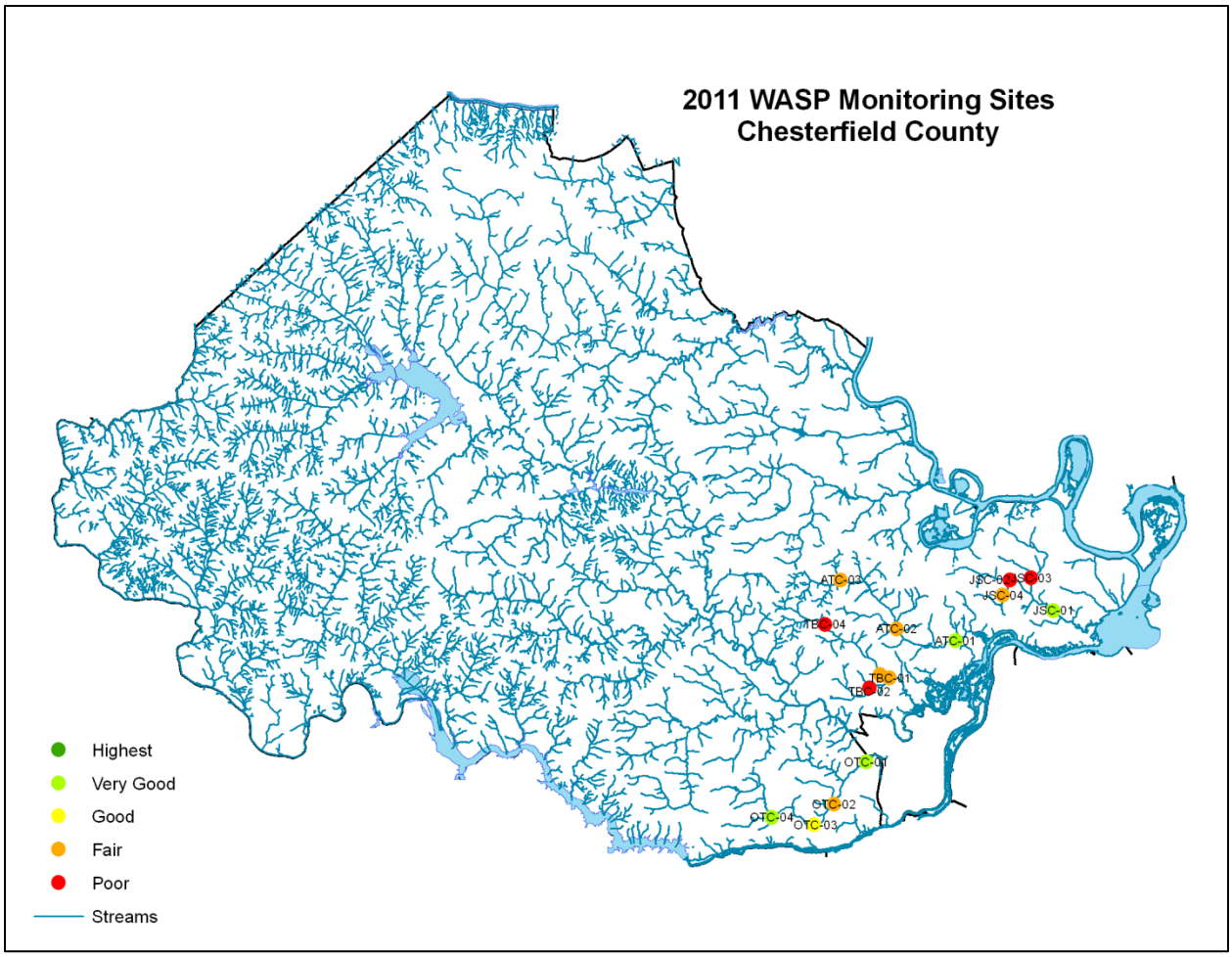
*( ) *Parenthesis denotes that* water body is listed for more than one impairment cause or for multiple sections

If a water body appears on the 303(d) Impaired Waters List, a Total Maximum Daily Load (TMDL) is required. A TMDL will identify the pollutant sources, solutions to remedy the pollutants, and a schedule for implementation. The TMDL process is a partnership between multiple state and local governmental agencies as well as nonprofits and private citizens. There are 11 TMDLs approved for five water bodies in the 2010 DEQ Integrated Report. In addition to these approved TMDL studies, Chesterfield County has a total of 61 impairments on 33 water bodies. There are more impairments than water bodies for several reasons. First, a water body may be listed for more than one impairment cause. For example, Goodes Creek is impaired for dissolved oxygen and pH. This would be counted as two separate impairments on one stream. Another reason the number of impairments is greater than the number of water bodies is that an entire stream or river may not be impaired, but several different locations along it may be. This is the case for Swift Creek. The entire reach of Swift Creek is not impaired for *Escherichia coli* (*E. coli*), though it has three separate *E. coli* listings for three different locations along the stream reach. In 2010, 28 new impairments were added to the Integrated Report, and 16 of these impairments were on water bodies not previously listed. The remaining listings were on water bodies that have previously been listed for other impairments in the past. In addition to listing newly impaired waters, DEQ will also delist waters that no longer violate water quality standards. This report delisted seven impairments in Chesterfield County, though three of the water bodies remain on the list for other impairments. Skinquarter Creek was previously listed for both dissolved oxygen and pH impairments; it was determined that the dissolved oxygen impairment was due to natural causes and the pH standard was no longer in violation; therefore it was delisted. In contrast, Oldtown Creek was also previously listed for dissolved oxygen impairments, delisted in 2010 for dissolved oxygen, but was then listed for pH and benthic macroinvertebrate impairments on the 2010 list. Finally, two impairments have been considered to be caused by natural conditions. All data from the 2010 Integrated Report is a summary of water quality conditions from January 3, 2003 to December 31, 2008.

Chesterfield County Monitoring Efforts

The Chesterfield County Department of Environmental Engineering, Water Quality Section, examines the water quality of Chesterfield County through a stream monitoring program referred to as the Watershed Assessment and Stream Protection Program, or WASP. This program is a critical component of the Chesterfield County Virginia Stormwater Management Program (VSMP) permit issued by the Virginia Department of Conservation and Recreation. The program encompasses both the ecological and chemical water quality of the streams of Chesterfield County through monthly monitoring of chemical parameters as well as an annual survey that assesses the biology, habitat and chemistry. This program was established in 2002 and has analyzed 82 stream segments in 11 of the 20 sixth order hydrologic units of Chesterfield County. In 2011, ten out of the fifteen streams sampled scored either fair or poor. Complete water quality reports and analysis can be found on the Chesterfield County website at: http://www.chesterfield.gov/content2.aspx?id=2852.





2011 WASP Monitoring Sites & Assessments		
Site Number	**Stream Name**	**Water Quality Score**
ATC-01	Ashton Creek	Very Good
ATC-02	Ashton Creek	Fair
ATC-03	Ashton Creek	Fair
JSC-01	Johnson Creek	Very Good
JSC-02	Johnson Creek	Poor
JSC-03	Tributary to Johnson Creek	Poor
JSC-04	Tributary to Johnson Creek	Fair
OTC-01	Oldtown Creek	Very Good
OTC-02	Oldtown Creek	Fair
OTC-03	Oldtown Creek	Good
OTC-04	Oldtown Creek	Very Good
TBC-01	Timsbury Creek	Fair
TBC-02	Tributary to Timsbury Creek	Poor
TBC-03	Timsbury Creek	Fair
TBC-04	Timsbury Creek	Poor

Data Sources

The following data sources were used in this report. Specific questions regarding any of the data or methodology used in this document should be directed to Heather Barrar at the Chesterfield Planning Department, (804) 748-1778, or barrarh@chesterfield.gov.

Data Sources by Section

Land

Land Developed, *based on the 2011 calendar year*

- Land Disturbance Permits, Chesterfield County Department of Environmental Engineering

Land Protected, *to date as of November 30, 2012*

- Park, open space easement and Resource Protection Area data: Chesterfield County
- Conservation easement data: Virginia Department of Conservation and Recreation, Division of Natural Heritage

Land Zoned, *based on the 2011 calendar year*

- Chesterfield County Planning Department

Air

All air data is based on the 2010 calendar year

- Virginia Department of Environmental Quality

Water

State water data is based on the 2008 calendar year (published in 2010); Chesterfield County Water Data is based on the 2011 calendar year

- Virginia Department of Environmental Quality
- Chesterfield County Department of Environmental Engineering

Web Sites Utilized

Chesterfield County: www.chesterfield.gov

Virginia Department of Environmental Quality: www.deq.virginia.gov

Virginia Department of Conservation and Recreation: www.dcr.virginia.gov

Appendix A: Glossary

Benthic Macroinvertebrate – A group of invertebrate animals such as snails, crayfish and insect larvae whose habitat is the stream bed. Because certain species are more tolerant to water pollution than others, they are often used as an indicator species for general water quality parameters such as dissolved oxygen, nutrient enrichment and sedimentation. They are not affected by bacteria.

Chesapeake Bay Ordinance – Chesterfield County Ordinance adopted in 1990 as a result of the Chesapeake Bay Preservation Act enacted by the Virginia General Assembly in 1988. The act requires local governments to include water quality protection measures in their ordinances to protect environmentally sensitive lands and water quality.

Chlorophyll-a- A pigment found in plants, including algae, that is measured to indicate the presence of algae blooms in water bodies. Excessive algae concentrations decrease the amount of sunlight entering the water and decomposing algae can decrease dissolved oxygen levels.

Dissolved Oxygen - The amount of oxygen available in water. Dissolved Oxygen is important due to the fact that most living organisms require oxygen for their basic metabolic processes. Oxygen is dissolved in water through diffusion, surface turbulence and photosynthesis of aquatic plants. When oxygen levels in the water fall below 3-5 mg/L, most fish and marine organisms are stressed and cannot survive.

Escherichia coli (E. coli) – A specific species of fecal coliform bacteria, and the most commonly found species, which inhabits the digestive tracts of warm blooded animals. The Virginia standard for *E. coli* took effect in 2003 is a monthly geometric mean of 126 *E. coli* cells per 100 ml of water. These bacteria can be caused by human sewage, agricultural waste, pet waste or wild animal waste.

Fecal coliform - A group of coliforms that routinely live in the digestive tracts of warm blooded animals. The Virginia standard for most surface waters was a monthly geometric mean of 200 fecal coliform cells per 100 ml of water. These bacteria can be caused by human sewage, agricultural waste, pet waste or wild animal waste. The fecal coliform standard is being phased out for the *E. Coli* standard as of 2003.

Hydrologic Unit – Drainage areas that are delineated so as to nest into a multi-level hierarchical drainage system. All watersheds are hydrologic units but not all hydrologic units are watersheds.

Land Disturbance Permit - A permit issued by the Chesterfield County Department of Environmental Engineering for the clearing, filling, excavating, grading or transporting of

land or any combination thereof for the purpose of developing a property for a single family home, subdivision, business, road or utility easement. A permit may be found at: County of Chesterfield, VA | Environmental Engineering Documents and Forms - Environmental Engineering

PCB – Polychlorinated Biphenyls, or PCBs, are chlorinated compounds that were commonly used in transformers and as coolants and lubricants. PCBs were banned in the late 1970s due to the toxic nature of the compounds. PCBs are known to cause cancer in animals are considered a persistent pollutant that bioaccumulates in animals. PCB has been found in fish tissue in the James River.

pH - Measures the acidity or alkalinity of a solution. Generally, the ability of aquatic organisms to complete a life cycle greatly diminishes as pH becomes as high as 9.0 or as low as 5.0. Water dissolves mineral substances it contacts, picks up aerosols and dust from the air, receives man-made wastes, and supports photosynthetic organisms. All these processes affect pH.

Richmond Region – For purposes of air quality monitoring, the Richmond Region includes the following jurisdictions: Charles City County, Chesterfield County, Hanover County, Henrico County, Prince George County, City of Colonial Heights, City of Hopewell, City of Petersburg and City of Richmond.

TMDL – Total Maximum Daily Load, or the amount of pollution that a water body can receive and still meet water quality standards. Once a water body is listed on the 303(d) Report on Impaired Waters, a TMDL must be established for that water body. The TMDL process is managed by both the Virginia Department of Environmental Quality and the Virginia Department of Conservation and Recreation.

WASP – The Chesterfield County Watershed Assessment and Stream Protection Program was established in 2002 to protect, preserve and restore the ecological integrity of the county's watersheds, streams, and other water resources through a comprehensive monitoring program.